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1214632 COMPLETE SPECIFICATION

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Fig.1.

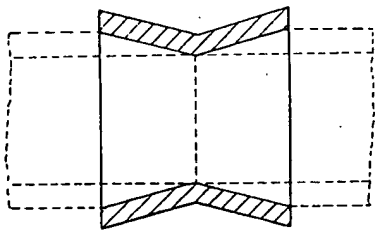


Fig.2.

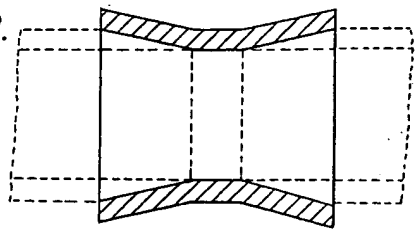
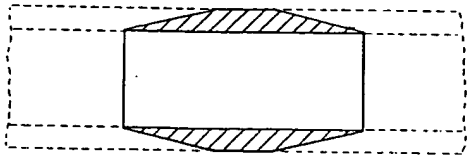


Fig.3.



Thermoplastic Pipes

Join using Heating Method

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PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) METHOD OF JOINING THERMOPLASTIC PIPES

(71) We, CHEMICAL PIPE & VESSEL COMPANY LIMITED, of Frimley Road, Camberley, Surrey, a British Company; and GEORGE CRAWFORD TYCE, a British subject of 3 Coolarne Rise, Camberley, Surrey, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to thermoplastic pipe joints and a method of making them.

In accordance with the present invention there is provided a method of joining thermoplastic pipes and/or pipe fittings, which comprises providing the ends of the pipes and/or fittings to be joined with complementary tapers, as hereinafter defined, such tapers defining a female socket and tubular male spigot, heating the complementary tapered surfaces whilst apart to melt the tapered surfaces and introducing the spigot into the socket thereby to bring the molten complementary tapered surfaces into contact.

By "complementary tapers" is meant not only that the angle of taper is the same for the female socket and the male spigot, but that the maximum and minimum internal diameter of the tapered portion of the female socket are same as the minimum and maximum diameter of the tapered portion of the male spigot. The female socket and the male spigot can thus be brought together in such a manner that little or no bead is formed at either end of the joint contrary to the case with parallel fusion. This is in contrast to known joints employing tapered end surfaces on the pipes, the one being a force fit within the other, the consequence being that a substantial bead is formed which, in some cases may block the pipe or at least substantially restrict the cross-sectional area thereof. If desired, the mating ends can be twisted with respect to each other through a small angle in order to ensure even spreading of the weld material or adhesive, but this is not necessary. Substantially bead-free joints having substantially 100% area contact between the mating surfaces are obtained without this twisting. Another particular advantage obtained with the joints of this invention is that they can be made having no internally projecting surfaces or internal grooves or channels. These can be particularly disadvantageous in pipe systems handling radioactive materials since such surfaces can act as a trap in which radioactive material may accumulate.

The tapers on the pipes or pipe fittings, may either be preformed, in which case it will be necessary to melt the tapered surfaces before the joint is formed, or it is possible to perform the tapering and melting operations simultaneously. In this latter operation use is made of a fusion tool having a tapered portion or portions adapted to engage over or in the end of a pipe or fitting, as the case may be. In order to form the taper, the tool is heated to above the melting point of the thermoplastic material and is then forced into or over the end of the pipe or fitting. If desired, a stop can be provided on the tool or on the pipe or fitting to limit the length of the taper. Also, in the case of an internal taper on a pipe or pipe fitting, it may be desirable to fit a restraining ring or band around the outside of the pipe or fitting to minimise distortion. Such a ring or band may for example be made of cellulose, thin gauge metal or perforated metal. When the surface of the pipe or fitting has melted, the tool is removed taking with it any excess of molten material and leaving a tapered surface already in a softened state and ready to be engaged immediately with a similarly formed taper in another pipe or fitting. Alternatively the tapers may be preformed using a cutting tool inclined at the required angle of taper. Whether the tapers are preformed and subsequently melted, or whether the two operations are preformed simultaneously as described, the two tapered ends having molten or fused outer and inner surfaces respectively, are presented one to the other, preferably with a slight twisting action. and the joint is then allowed to cool. If

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desired, one or both tapers may be provided with a shoulder or land at the inner end thereof, which serves as a stop to limit the length of the overlap. However, if desired, the tapers may finish flush with the surface of the pipe or fitting. In this case, it may be desirable to fit a ring or other stop member on the outer surface of the male member to limit the length of the joint.

The fusion tool used in preparing the tapered spigots and sockets on the pipe sections or pipe fittings used according to the invention is preferably constructed of a copper-free aluminium alloy since it has been found that copper and copper alloys and to a lesser extent steel have a degrading effect on some hot thermoplastic materials, particularly polyethylene and polypropylene. In order to avoid surface oxidation of the tool, as can occur when heated externally, the tool is preferably internally heated, for example by an internal heating element.

The angle of taper formed on the pipe section or pipe fitting will depend to some extent on both the diameter of the pipe or fitting and on the length of overlap desired. Generally the taper will be from 5°—20°. For a 2.3/8 inch outside diameter tube a 10°—12° taper 1.3/16 inch in axial length has been found satisfactory.

The invention is particularly applicable to the welding of polyethylene and polypropylene pipes and fittings. It is, however, applicable to other types of thermoplastic material, e.g. acrylic resins, methyl pentene polymers, nylon, polyacetals, polycarbonates, vinyl and vinylidene polymers, polystyrene and styrene-butadiene-acrylonitrile copolymers.

The invention is particularly advantageous in that long joints can be obtained which means that large pipes can readily be joined. The tapered ends are much more easily fitted together without danger of any substantial amount of molten material being forced into the bore of the pipe thereby avoiding starvation of weld material at the inner end of the overlap. Tests have shown that the area contact of the joints made in accordance with the present invention is in the region of 100%. Pressure and breaking tests made on the joints prepared according to the method of the invention show that the bursting and breaking strengths are greater than that of the pipe itself.

The method of the invention is illustrated by the accompanying drawings which illustrate methods of connecting two pipes together using three different types of connector. Of course it is equally within the scope of the invention to connect two pipes together without any intermediate connector.

Fig. 1 shows a connector consisting of two inwardly tapered sockets in back to back relation. The outer surface is correspondingly tapered so that the element is of constant wall thickness. Alternatively the outer surfaces could be parallel so that the wall thickness of the element increases to a maximum at the centre. The two pipe ends joined by the connector are shown in outline. Each pipe end is formed with a complementary taper matching the taper of the connector. In making the joint the tapered surfaces are heated to above the softening point of the thermoplastic material and then brought together. Because of the complementary matching tapers the mating surfaces approach one another as the joint is being formed along a line substantially normal to the two approaching surfaces.

Fig. 2 shows a similar connector in which the two tapered sockets are separated by a parallel intermediate section.

Fig. 3 shows a connector consisting of a tubular element the two ends of which are provided with external tapers.

As will be appreciated from the drawings each connector will accommodate a variety of pipes of different wall thickness for a given external diameter. Furthermore, the finished joint has a flush inside surface free of obstruction and free of traps for dirt and sediment. Also, because of the complementary tapered surfaces there is virtually no tendency for excess weld material to be pushed up into the bore of the coupling to form a bead.

Many other types of connector or fitting will of course be usable within the scope of the invention. In some cases it may be desirable for each socket to have two tapers of different angles. Alternatively, each socket may have a parallel section as well as the tapered section.

WHAT WE CLAIM IS:—

1. A method of joining thermoplastic pipes and/or pipe fittings, which comprises providing the ends of the pipes and/or fittings to be joined with complementary tapers, as hereinbefore defined, such tapers defining a female socket and tubular male spigot, heating the complementary tapered surfaces whilst apart to melt the tapered surfaces and introducing the spigot into the socket thereby to bring the molten complementary tapered surfaces into contact.

2. A method according to claim 1 or 2, wherein the pipe and/or pipe fittings are provided with complementary tapers at an angle of from 5°—20°.

3. A method according to claim 2, wherein said angle is 10°—12°.

4. A method according to claim 1, 2 or 3, wherein each taper is formed flush with the inside and outside surfaces of the pipe or pipe fitting.

5. A method according to claim 1, 2, or 3, wherein one or both tapers is or are formed

with a land at the inner end, which land limits the length of overlap of the two tapers when mated.

6. A method according to any one of the preceding claims, wherein the tapered socket and spigot on the pipes and/or pipe fittings to be joined are preformed and are heated to soften the tapered surfaces immediately before formation of the joint.

7. A method according to any one of claims 1—5, wherein the pipes and/or pipe fittings to be joined each have parallel sided end portions which are shaped to form a tapered socket and spigot respectively which are then heated to soften the tapered surfaces immediately before formation of the joint.

8. A method according to claim 7, wherein the tapering and softening operations are performed simultaneously.

9. A method according to any of claims 1—8, wherein the pipes and/or pipe fittings to be joined are of polyethylene or polypropylene.

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